SOCIOECONOMIC IMPLICATIONS OF PERSONNEL TRENDS IN FIELD SERVICE

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I INTRODUCTION

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- Next to programming, field service is the most labor intensive function in the computer industry.

  - In the U.S. a shortfall of at least 30,000 people is projected in the near term.

- To combat this shortfall problem, a number of new maintenance techniques are being developed, including:

  - Remote diagnostics.

  - System support centers.

  - Depot maintenance.

  - Built-in diagnostics.

  - Shifting of part of the maintenance burden on to the customer.

- In spite of these new efforts, the shortfall will continue to grow worse. As a result, computer companies will be forced to change the way maintenance is performed, and in doing so, will require a different mix of skills.

- This paper briefly describes how the sources of field service personnel are changing and gives INPUT's considered opinion of the structure, qualifications and skill levels of the service person of the future.

- The implications of these changes from a socioeconomic point of view are very significant to any highly industrialized country.

  - Tens of thousands of jobs will open up for relatively unskilled (technically) people. However, there will be increasing emphasis on communications skills.

  - The implications to those responsible for recruiting, developing and training future service personnel are:

    - More emphasis on "people" skills.

    - Less emphasis on technology.

II FUTURE REQUIREMENTS

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A. SOURCES OF PERSONNEL

- As shown in Exhibit II-1, there has been some shift in thinking between 1978 and 1980. Most vendors perceive (and INPUT agrees) that the majority of new field service people will, in future, come from trade schools and from the ranks of those having no prior technical training or skills.

  - This implies a relatively major investment in training facilities by the vendors themselves.

  - "Hire and train" moves from last position to second position among the alternative sources.

- "Recruit from competition," although decreasing in importance, remains a relatively important source of new people.

  - This industry-wide problem is obviously self-defeating and needs to be dealt with at the industry level.

  - INPUT urges the industry to "get its act together." Forums such as the Association of Field Service Managers can serve as a vehicle to initiate industry-wide discussion that could lead to improving new personnel training.

EXHIBIT II-1

VENDOR RATINGS OF PRIMARY SOURCES OF
NEW FIELD SERVICE PERSONNEL

VARIABLE	YEAR			
	1978	1980	1982	1985
HIRE AND TRAIN (NO TECHNICAL PRE-TRAINING)	2.0	1.8	2.8	3.5
RECRUIT FROM COMPETITION	3.0	2.9	2.8	2.1
RECRUIT FROM INDUSTRIES	2.3	2.1	2.6	2.4
TRAIN DISCHARGED ARMED SERVICES PERSONNEL	2.6	2.5	2.4	1.9
RECRUIT FROM OTHER FUNCTIONS WITHIN THE COMPANY	2.7	1.9	2.5	2.2
TRADE SCHOOLS	2.9	3.7	4.0	4.1

(SCALE: 1 = LOW, 5 = HIGH)

B. SERVICEPERSON OF THE FUTURE

- By the mid-1980s the service organization will evolve into a three-tiered structure. At each level, different types of people will be required to meet the service demands of the integrated computer/office/communications systems in place at that time.

- Within this hierarchy, each level has its own role in the service organization, performing different functions and interfacing with customers in different ways and often at different levels (i.e., the skills, training, handling and compensation requirements will be significantly different for each category).

- Due to economic necessity, some of the functional requirements of the three levels may overlap, depending on customer base, product line density, geographic dispersion of specific products and other factors. In most organizations, however, the lines will be distinctly drawn.

- The three classes of service personnel and their distinguishing characteristics are described as follows:

1. LOCAL FIELD SERVICE TECHNICIAN (LFST)

- LFSTs exist primarily to handle routine service functions such as:

    - "Cookbook" preventive maintenance diagnostics and routines.

    - Repair at the module or unit replacement level.

    - Cleaning and burnishing of mechanical components.

- Skill and technical training requirements for LFSTs will be relatively minimal.

    - A high-school education will be sufficient.

- Since they interface directly with customers, appearance and communication skills will be important attributes.

- This category will be largely non-exempt and will be the area within the field service organization most susceptible to union encroachment.

- Coincident with a heavy influx of this new class of employee, companies will need to have programs in place to detect and train those individuals capable of progressing beyond this basic level.

2. LOCAL FIELD SUPPORT SPECIALIST (LFSS)

- LFSSs serve as backup to the LFSTs, taking charge of problems they cannot deal with. They must have a thorough grounding in the theory of operations of the systems with which they will come in contact.

- Most positions will require the equivalent of a four-year degree. Most will need to comprehend both software and communications.

- LFSSs will be generalists capable of making decisions on nonroutine problems as they come across a broad spectrum of products and systems.

- LFSSs are professionals in the usual sense of the word. They need to look and act like professionals.

    - In many organizations, LFSSs will serve an important role in field service marketing and sales. They may, in fact, have responsibility for the creation and sale of maintenance programs for individual customers.

    - Depending on the size of the field service organization, LFSSs may be at regional as well as local levels.

3. CENTRAL SITE SUPPORT SPECIALIST (CSSS)

- CSSSs are resident at headquarters or regional locations and are responsible for dealing with highly technical problems beyond the capabilities of field personnel.

- CSSSs are specialists in every sense of the word. They have in-depth knowledge of specific products; indeed, their knowledge may be limited to an individual subset of a complex system, like, for example, the central logic unit, or the operating system software package.

- In-house training will frequently include participation in system design, development engineering or software development teams originally responsible for a product.

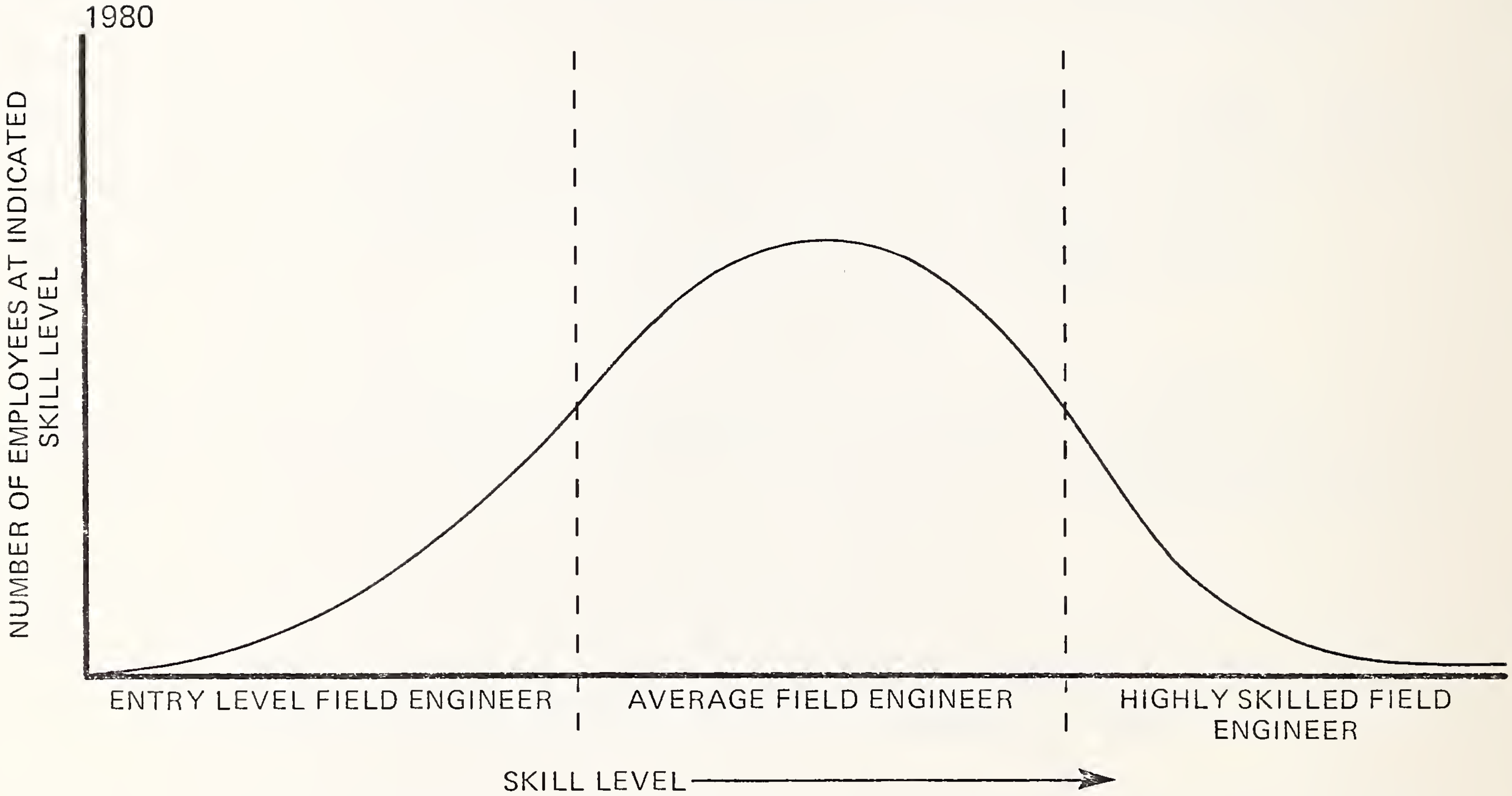
- It will be extremely difficult to retain these people in the same job for long periods of time since constant updating will be required. Field service should be prepared to staff these positions on a rotating assignment basis.

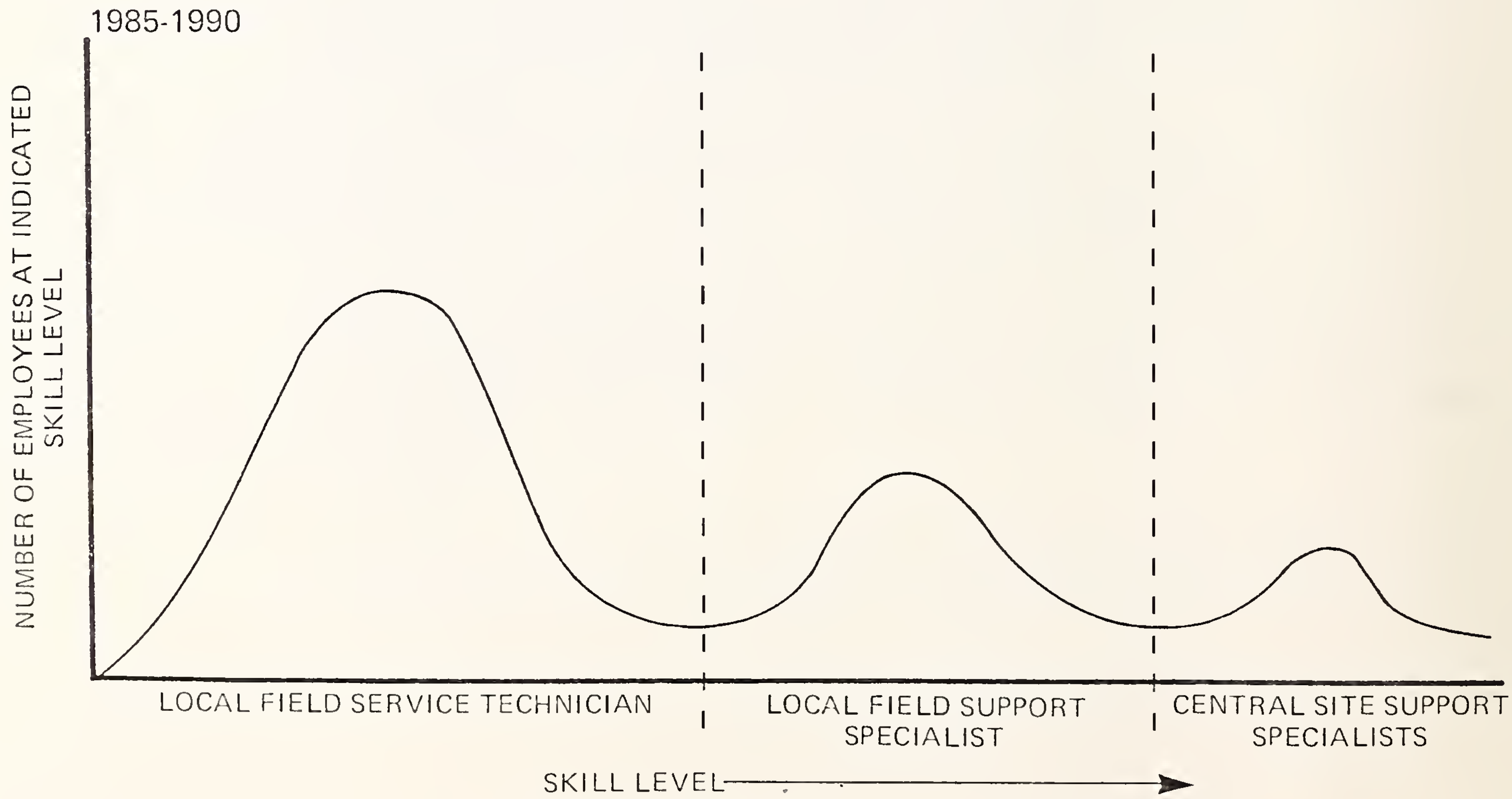
- CSSSs will often be located in national centers with responsibility for their specialty over large geographic areas. A configuration beginning to appear is to have a U.S. center, a European center and a Far East center.

- The change in the distribution of skills in a field service organization is shown graphically in Exhibit II-2.

EXHIBIT II-2

SHIFT IN DISTRIBUTION OF SKILL LEVELS
OF FIELD SERVICE PERSONNEL





III IMPACT OF REMOTE DIAGNOSTICS

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A. BACKGROUND

- Although remote diagnostics have been available for years in the general computer maintenance environment, vendors are just beginning to exploit its potential to significantly improve maintenance services and reduce costs.

- The concept of remote assistance to field engineers is not new. What is new are the methods of delivery and control.

  - Remote assistance began as "lists" of the most qualified trouble-shooters in an organization. By the mid-1960s, it was run by organized staff personnel with rigid procedures and controls.

  - Remote diagnostics represents one of the logical extensions in the development of tools used in technical support.

B. DRIVING FORCES IN REMOTE DIAGNOSTICS

- Personnel utilization is the primary driving force behind the development of remote diagnostics.

- Vendors are designing equipment and maintenance plans around the obstacles created by shortages of field engineering skills, or by a desire to retard growth in field engineering forces.

- Vendors are taking the position that they have historically played rather a passive role in the evolution of field engineering, and they now want to play a more active role.

- Because little time has passed to collect and isolate cost data on new systems, details are not available on the capital investment issues surrounding remote diagnostics. Some general guidelines, however, are available.

    - Most vendors require an 18- to 30-month payback on this type of investment.

    - All the vendors reporting expected paybacks say that they are on target.

    - The range of estimated remote diagnostics development cost is from 2% to 15% of the equipment development cost.

- Field engineering management has been successful, in most cases, in passing on the most significant operating expenses associated with remote diagnostics to the customer or to the sales margins.

C. IMPACT ON FIELD ENGINEERING PERSONNEL

- Field engineering personnel attitudes are being adversely affected by the implications of remote diagnostics.

    - Many experienced field engineers feel a loss of control over customer satisfaction.

- Effective management communications with field engineers is lacking.

- Management does not appear to be aware of the true attitudes of field engineers toward remote diagnostics.

• The remote diagnostic issue has the potential of being a "threshold" event in labor union organization efforts. Unions may find field engineers receptive to their organization efforts as job security is threatened.

D. IMPACT OF TECHNOLOGY ON REMOTE DIAGNOSTICS

• The state of the art in remote diagnostics is well ahead of the human capacity to adapt to change. This is evidenced by the wide discrepancy between the current state of remote diagnostics, and the users' perceptions of remote diagnostics.

• Current models of remote diagnostics range from electronically "looking over the shoulder of the local field engineer" to completely automated check-out of terminals with operator prompting.

• The recent announcement by Hewlett-Packard of a maintenance agreement that specifies 99% hardware up-time is a dramatic example of the impact of technology.

  - More reliable hardware is largely technologically driven.

  - The new HP 3000 Series 44 computer system, on which the offer is made, features a control and maintenance processor that makes extensive diagnostics available, and remotely accessible.

- Prime reliance for maintenance is still on local support, however, with the guarantee offer restricted to installations within 100 miles of an HP Primary-Service-Responsible office (SRO).

- Remote diagnostics also tend to be used on smaller mainframes. IBM's General Systems Division recently announced a Remote Testing Service for its System 38 small business computer, which is primarily an implementation aid for users converting from the older System 3. An IBM remote support representative can access programs, test data and observe program execution.

E. CURRENT STATUS OF REMOTE DIAGNOSTICS

- Only 10% of a sample of vendors used for the 1980 Field Service Annual Report indicated no immediate plans for remote diagnostics.

  - Of the remaining 90%, approximately one-half had implemented some remote diagnostic capability.

  - The other half had firm plans to implement remote diagnostics on new products, with scattered reports of retrofitting the capabilities to existing equipment.

- In the technological sense, the limiting factor is not in the robot and communications segment, but in the quality and reliability of the diagnostics themselves.

  - Remote access and control of operator and maintenance consoles is a relatively simple electronic achievement.

  - Remote control, however, can add no amount of reliability to the interrogative and data-reporting capabilities of the diagnostic.

- At present the value added in most instances is the quicker introduction of interpretive capabilities to the local situation via remote hook-up.

    - One company reports that as many as 15% of the calls on peripherals are now avoidable because of their remote verification process, which aids the dispatch center in directing users to call their mainframe maintenance vendor in those cases where the fault lies with the mainframe.

APPENDIX

APPENDIX: TYPICAL MODELS OF REMOTE DIAGNOSTICS

NOTE: The information contained in this appendix is excerpted from INPUT's report, Remote Diagnostics.

A. EXAMPLE OF PLUG COMPATIBLE PERIPHERAL EQUIPMENT

I. CONFIGURATION

- The configuration of a typical peripheral remote diagnostics system for plug compatible equipment is diagrammed in Exhibit A-1.

- A microprocessor is added to the peripheral subsystem controller.

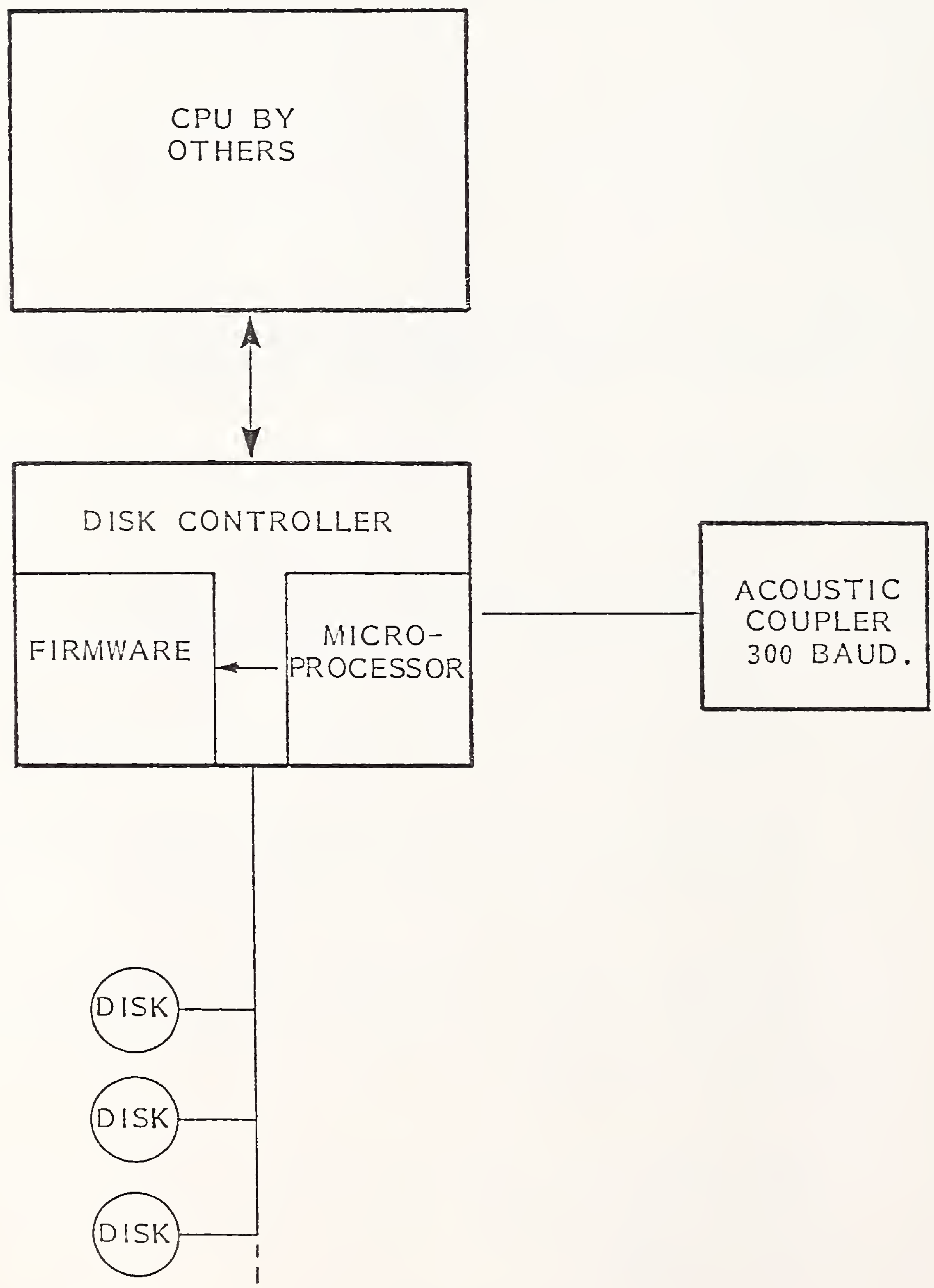
  - The microprocessor is connected to a remote terminal device via a dial-up line and acoustic coupler operating at 300 baud.

  - The microprocessor is hard-wired to interface directly with the controller firmware, driving the controller's internal operating microprocessor and internal diagnostics.

  - The remote field engineering specialist has access to the subsystem firmware via the remote terminal, the acoustic coupler and the microprocessor.

EXHIBIT A-1

PLUG COMPATIBLE EQUIPMENT VENDOR
SYSTEM - SCHEMATIC



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- Using the interfaces provided, the remote field engineer is able to exercise the controller and/or associated devices.

- Results of the tests and exercises can then be transmitted to the remote terminal for analysis.

2. SUPPORT SYSTEM OPERATION

- A user with a suspected problem calls the field engineer on duty to discuss the symptoms.

- The field engineer instructs the user operator to:

    - Remove media from devices to be tested.

    - Mount scratch packs or CE test packs as required.

    - Connect the telephone to the acoustic coupler and enable the remote diagnostic switch.

- The field engineer then tests the subsystem via remote hookup.

- If results displayed on the remote terminal verify that the subsystem is operating correctly, the field engineer informs the user to contact the host CPU maintenance vendor.

- If negative results are received, the field engineer arranges for a local field service representative to be dispatched who has been given considerable diagnostic information about the problem in advance.

3. BENEFITS

- This system, according to one vendor using it, reduces calls approximately 15% by eliminating the problems caused by the host CPU or interference from other vendor products on the same I/O channel interfaces.

- Users like the system because it helps reduce the total response time in multiple-vendor operations.

- Field engineers like the system because it reduces the times they are called out unnecessarily.

B. EXAMPLE OF DISTRIBUTED PROCESSOR

1. CONFIGURATION

- Exhibit A-2 represents a typical configuration of a distributed processor employing remote diagnostics.

- Distributed processors lend themselves naturally to remote diagnostics due to the loosely coupled networks inherent in the operational design of the systems configurations.

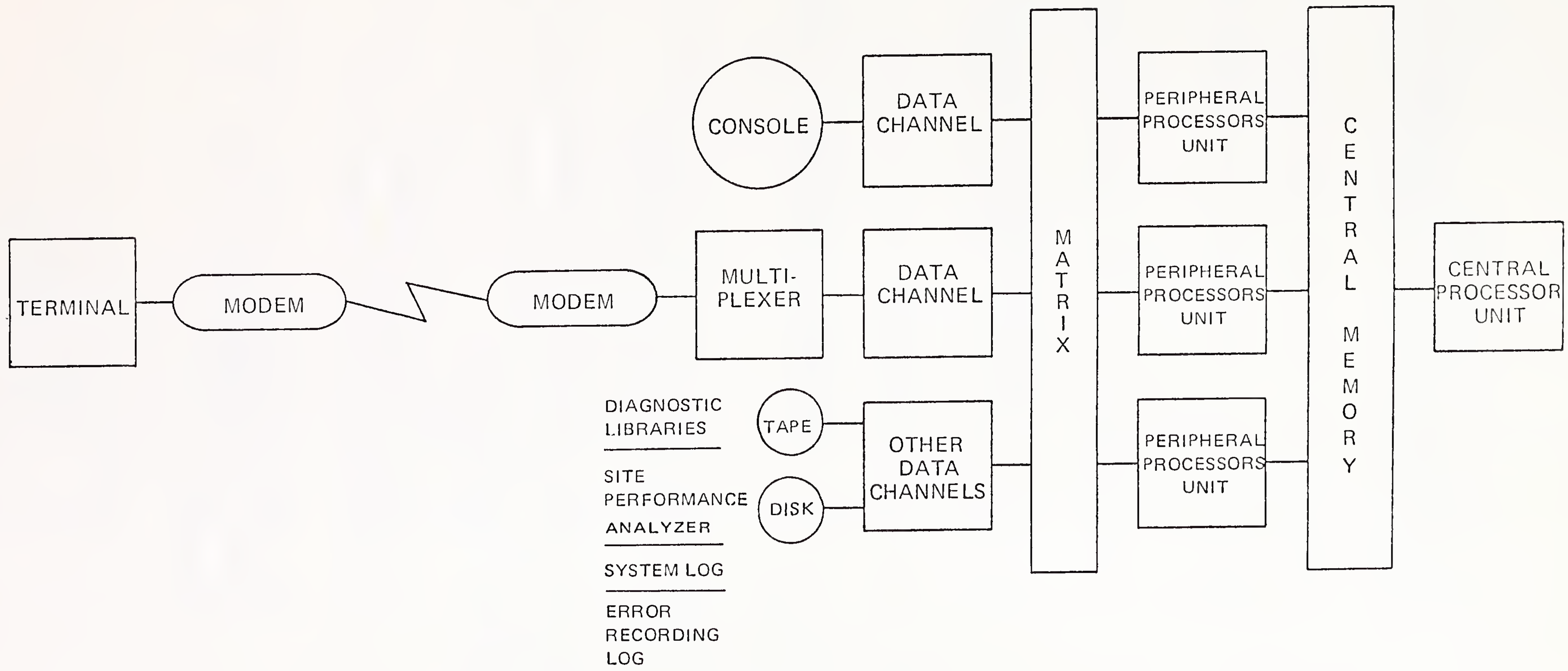
- Access to the system is via modem to the system's communication network multiple subsystem.

    - The subsystem is linked via a data channel coupler to the host system.

    - The data channel connects to a peripheral processor unit via a matrix switch, and the peripheral processor has access to central memory and the central CPU.

EXHIBIT A-2

REMOTE DIAGNOSTICS ON A DISTRIBUTED PROCESSOR



- Any compatible terminal device, usually a SILENT 700 with an acoustic coupler, may be used to gain access to this type of system.

- Access is established using normal protocol and security passwords.

- Users have the power to inhibit the running of remote diagnostics by software switches.

- Diagnostics can be run as normal user jobs in the job stream.

- The operator is usually notified of data exposure, and is able to lock out the affected user by software switches or masks.

2. SUPPORT SYSTEM OPERATION

- Exhibit A-3 illustrates a typical hierarchy of support procedure associated with this system.

- The customer will call a dispatching number to have the trouble logged in and to have the remote diagnostic process initiated.

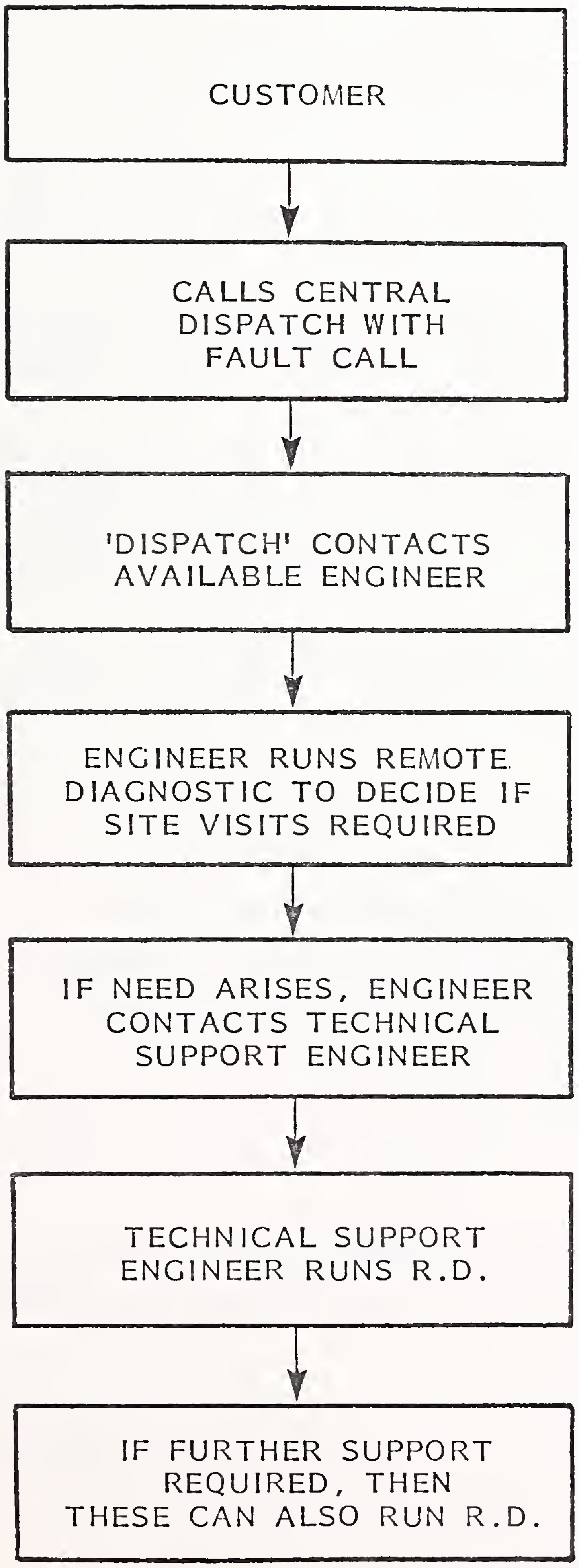
- The field engineer responsible for the customer group uses remote diagnostics to interrogate the system's error log analyzer, the operator log and the performance history analyzer.

  - Systems error logs contain statistical data from parity errors, unusual condition interrupts, system degradation, etc.

  - The operator log contains information entered by operators regarding various types of cold starts, warm starts, and other recovery procedures.

EXHIBIT A-3

DISTRIBUTED DATA PROCESSING
OPERATIONAL PROCEDURE



- The performance history files contain information on system configuration, details of past failures, unresolved problems, mean time to failure statistics, etc.

- The field engineer can use portions of the current maintenance/diagnostics library routines to exercise system components as a user.

- Depending entirely on the field engineer's and operator's judgement, other users can be locked out during the tests to assure data integrity.

- If necessary, the field engineer can take over the entire system to run dedicated diagnostics. In this mode, the field engineer can normally run voltage margins remotely as well.

  - Appropriate information is normally available at this point to follow through with the normal support procedural decisions.

- Higher levels of support also have access to remote diagnostics if called in to support the local field engineer.

3. BENEFITS

- Diagnostics designed for distributed processors to isolate problems to networks, matrices, peripheral processors, intelligent terminals or other constituents of the system can now be invoked remotely as a job entry.

- Field engineers are able to work from any location in which they have access to a terminal, even at home.

- This system supports a decentralization of talent giving additional mobility to the field service organization and reducing branch office overhead.

C. EXAMPLE OF LARGE MAINFRAME - IBM 303X

1. CONFIGURATION

- The remote diagnostics system is linked through the 3036 "Dual Display Console" on the IBM 303X, as shown in Exhibit A-4.

  - The modem and linkage operate at 1,200 baud.

  - The IBM "RETAIN" system, the data base used by the support system, is linked into the network along with technical support center personnel.

- The on-site field engineer, the remote assistance engineer (when required), and the RETAIN system are integrated to form a complete diagnostic aid, remote diagnostics, and remote assistance network.

- The 3036 console is controlled by two interchangeable microprocessors, each with dedicated CRT, keyboard, floppy disk and I/O interface channel.

  - The operator station is used for normal operator interface with the system.

  - The service support station is used primarily for maintenance. It can display system status, error logs, system failures and other faults. It is used to run and control diagnostic routines.

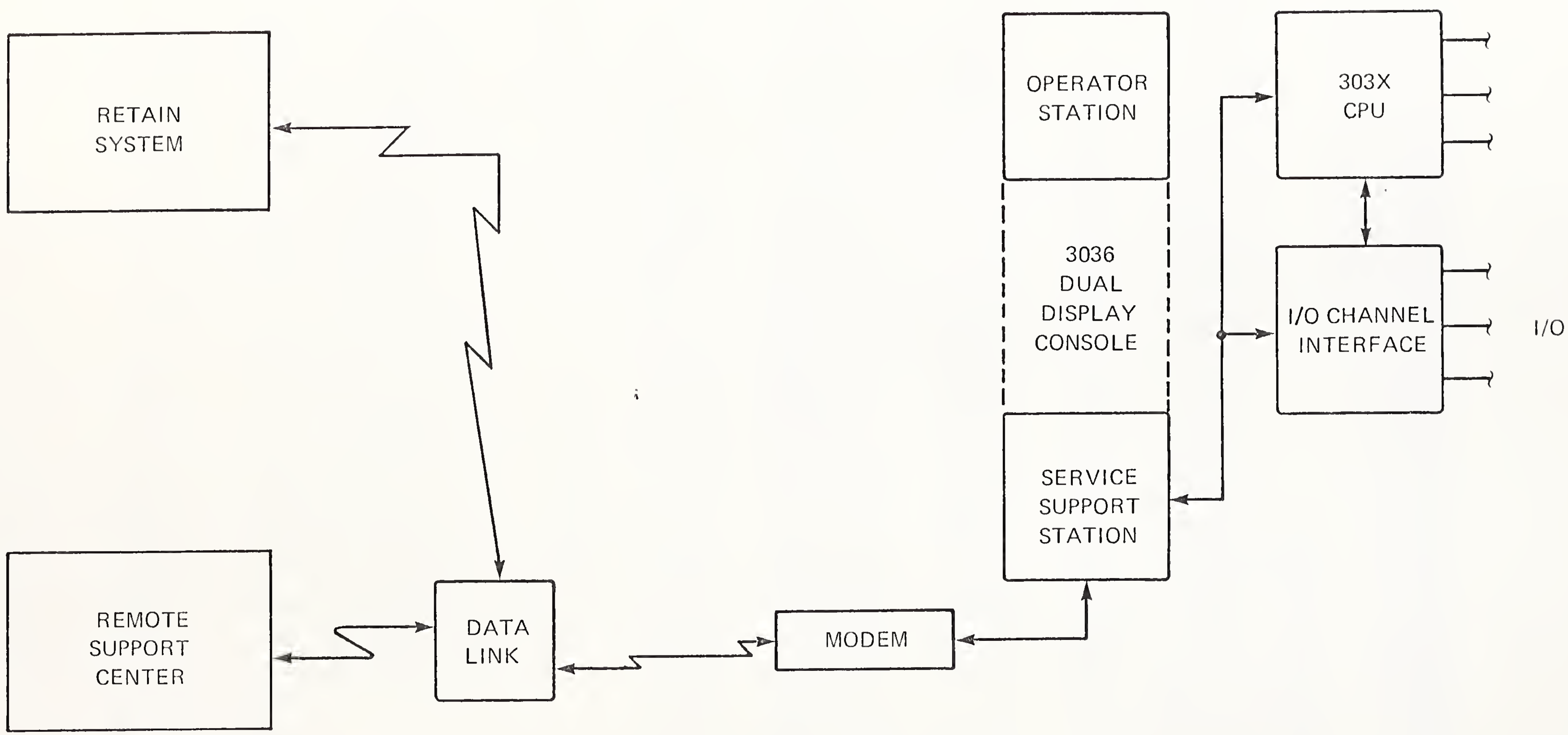
2. REMOTE SUPPORT SYSTEM OPERATION

- The IBM support system currently operates on the premise that the field engineer will be on-site.

- The RETAIN system is a data base system and diagnostic aid accessible to field engineers prior to remote diagnostics.

EXHIBIT A-4

IBM 303X REMOTE DIAGNOSTIC SYSTEM



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- The RETAIN system, outlined in Exhibit A-5, contains the following information and options:

  - Information on fault symptoms.

  - Fixes.

  - Service techniques.

  - Engineering change information.

  - Customer log transfer option.

  - Remote console operation option.

- The remote console operation option creates the remote diagnostic capability, while the customer log option further increases the capabilities of remote diagnostic assistance by technical specialists.

- By exercising the remote console option, the remote support specialist can take control of a dedicated system and perform the following:

  - Run system diagnostics.

  - System reset.

  - Clear memory.

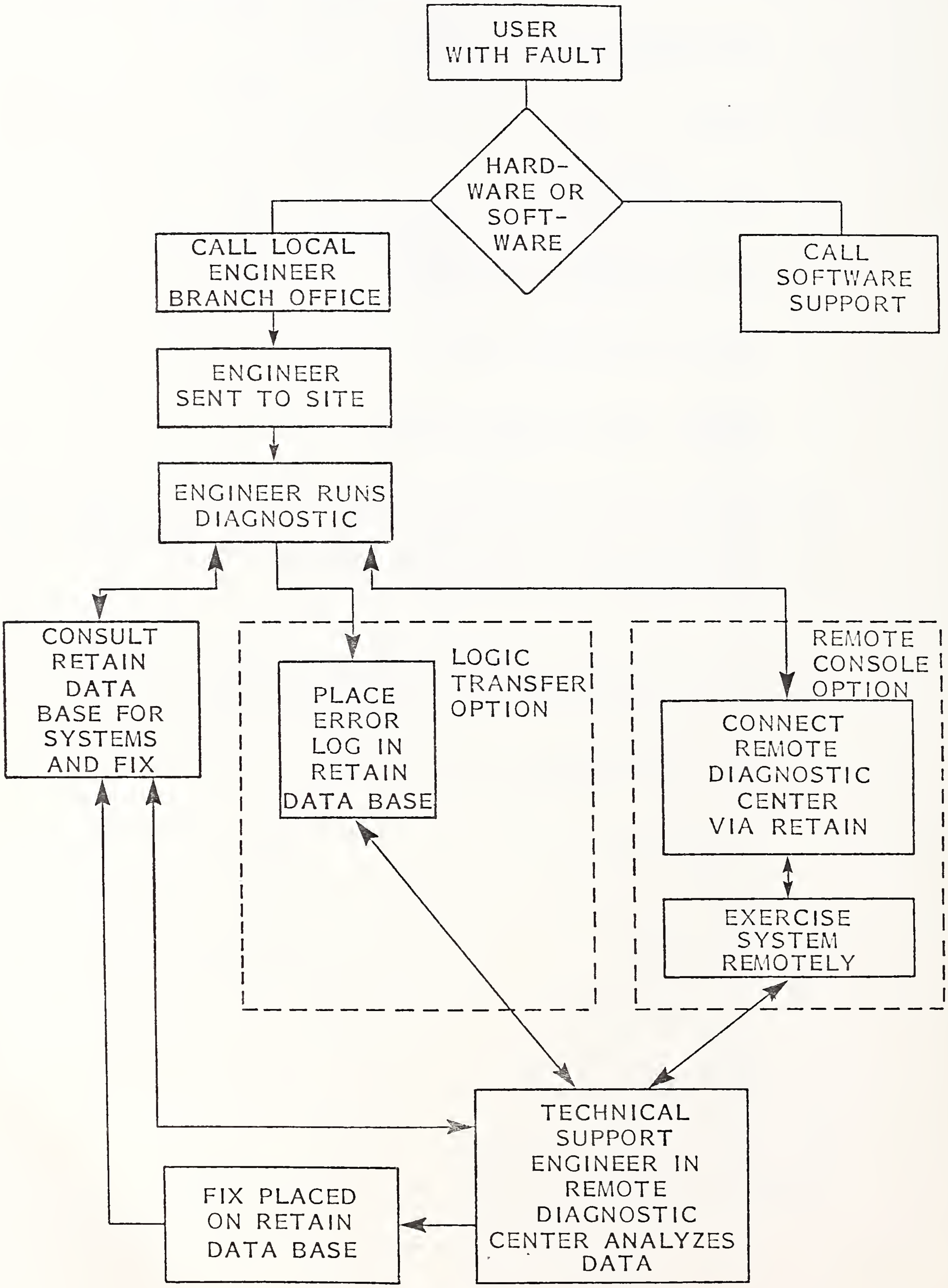
  - Step single cycle.

  - Perform on-line tests.

  - Measure and vary voltages.

EXHIBIT A-5

IBM "RETAIN" SYSTEM SCHEMATIC



- Check system status indicators.

- Display logs.

- Scan data banks at RETAIN for similar faults.

- When the fault is located and repaired, RETAIN data bases are updated.

- Exercising the log transfer option prior to running diagnostics is normally done to allow other remote research to be performed, matching data with RETAIN symptom indices, etc., concurrently with remote diagnostics.

3. BENEFITS

- The integration of remote diagnostics with other remote maintenance aids available through RETAIN provides the local field engineer with maximum support while enhancing customer respect for local control.

- Quick involvement of remote analysis significantly reduces outage.

- Error log dumps into the RETAIN data base allows multiple, specialized involvement and interaction with the latest historical information for the local field engineer.

- International "RETAIN" data bases are updated immediately to avoid "reinventing the wheel" on similar problems.

D. OTHER EXAMPLES

- Variations of the preceding examples by category are presently installed.

- One large mainframe vendor has a support system that allows support specialists to monitor outputs from diagnostics being run by the on-site field engineer. The added dimension of visual, real-time interface with the system under repair creates a synergistic and productive effect that qualifies the system as "remote diagnostics."

- The DEC PDP 11/70 remote diagnostics system operates very much like the IBM 303X, with or without a local field engineer on-site.

- A small business system and distributed data processing system vendor is providing customers with the capability to dial up automated remote diagnostics with operator prompting.

  . The central diagnostic control system is programmed to give the user an appropriate message that a call for service should be placed.

  . This system is not currently integrated with central dispatch to anticipate calls for service.

• Most vendors plan for remote diagnostics in the next generation to facilitate users' involvement.

  - Direct dial-up capabilities are anticipated to allow remote monitoring of "live" diagnostics running in the background.

  - More automated systems are planned with the capability of prompting users with steps to take as they proceed through the remote diagnostic routines.